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Abstract	I wish to explore the link between interpretation ofmetaphors and generics in natural language, in support of a claim that the mechanisms and processes of interpretation for metaphors and generics are closely related through word sense modulation. Both tropes have curious truth conditions. In a strict literal sense (4.1), (4.2), (4.3), and (4.4) are false.

Chapter 4
Genericity and Metaphoricity Both Involve Sense Modulation

Carl Vogel

4.1 Background

I wish to explore the link between interpretation of metaphors and generics in natural language, in support of a claim that the mechanisms and processes of interpretation for metaphors and generics are closely related through word sense modulation. Both tropes have curious truth conditions. In a strict literal sense (4.1), (4.2), (4.3), and (4.4) are false.

Sumo wrestlers are elephants. (4.1)
Sumo wrestlers are bean-poles. (4.2)
Sumo wrestlers are Japanese. (4.3)
Sumo wrestlers are Dutch. (4.4)

Strict literal senses depend upon universal applicability to individuals of the kinds about which the predications are made. No sumo wrestler really is an elephant, and there are many counterexamples to any claim that all sumo wrestlers are Japanese, such as the reading of (4.3) with implicit universal quantification suggests. Loose literal senses depend on existential assertions about the applicability to some individual or other as a member of a "witness set" in support of the claim.[1] A loose literal sense may be regarded as non-literal. It is reasonable to assert, in a non-literal sense for each, that both (4.1) and (4.3) are true (or to deny them).[2] The example (4.3), with a bare-plural subject, can be used to express either that all sumo wrestlers are Japanese ("strict", but false) or that some are ("loose", and true). In the strict literal sense, non-negated metaphors and generics are false; however, it is loose evaluation that appears to underpin common use of both. I argue that both metaphors like (4.1)

[1] Witness sets, as invoked in generalized quantifier theory, explain how the cognitive load required to evaluate predications of noun phrases depends on the determiners' monotonicity properties [2].
[2] For an example of (4.3) used as a generic, see: http://answers.yahoo.com/question/index?qid=20080320042727AALZv3Z – last verified January 2011.

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and generics like (4.3) can be understood in terms of belief revision in first order languages augmented with sense distinctions. In this framework, both metaphors and generics are contingent (e.g. (4.2) and (4.4) are false in their respective special senses).

Negations highlight the contingency of metaphors and generics further. The canonical example of negated metaphor, Donne's (4.5), can be used to show that the negation of a metaphor is "patently" true [7]. Less aphoristic examples clarify that the truth of negated expressions, like non-negated ones, depends on the situations described. Examples (4.6) and (4.7) contain sentential negation. These are strictly true. They can also be seen as metaphorically false (if evaluated in situations that contain individuals who are extremely massive in relation to normal body mass for sumo wrestlers). Moreover, the form of negation interacts: (4.8), which involves a negative determiner in the subject noun phrase, is also strictly true. However, (4.7) can be metaphorically true in situations where (4.8) is metaphorically false, such as those where some sumo wrestlers are aptly characterized as elephants and some are not.

No man is an island. (4.5)
It is not the case that sumo wrestlers are elephants. (4.6)
Sumo wrestlers are not elephants. (4.7)
No sumo wrestler is an elephant. (4.8)
It is not the case that sumo wrestlers are Japanese. (4.9)
Sumo wrestlers are not Japanese. (4.10)
No sumo wrestler is Japanese. (4.11)

Where metaphoricity of the predication is not at stake, but rather the genericity of the utterance, under a strict literal interpretation as above, the sentential negation makes (4.9) and (4.10) true, since it is not the case that all sumo wrestlers are Japanese. In fact, this strict reading of the bare plural subject as involving universal quantification within the scope of the negation seems strongly dis-preferred. Allowing a loose, generic reading makes the truth depend on regularities in the world (in which case, it is false if focus is restricted to the Japanese wrestlers, and true if focus includes the sumo wrestlers born outside Japan). Interestingly, the negative determiner blocks a generic reading for (4.11), but in any case the truth of falsity of the sentence depends on facts about the world and with which sense one wishes to evaluate the sentences. I am concerned here with both the contingency of metaphorical and generic assertions and the constraints on interpretation introduced by negation.

Influenced by work in dynamic semantics that formalized accounts of anaphora in discourse as eliminating possible models of sentences with pronouns, on the basis of restricting assignment functions that map variables into the domain, as pronouns are resolved to potential antecedents [13, 16], as well as research in belief revision [1, 22] proposed a framework for first-order logical languages which admitted both information increase and retraction ("updates" and "downdates", respectively). Carl Vogel [27] proposed a comparable system for information increase only, but with the additional dimension of intensionality in that indices for interpretation were provided to account for the multiplicity of senses that a predicate name or name

of individuals might have. That system provided for classical static interpretation (but relativized to senses) and dynamic interpretation, which in all but certain well-defined syntactic and semantic contexts may allow the update and downdate of characteristic functions of sets that provide denotations of relation names and constants. Metaphoricity is captured as a partial order that classifies indices, thus accommodating the intuition that today's novel metaphor is tomorrow's conventionalized non-literal expression, and the next day's dead metaphor, literal language. The system exploits the fact that natural languages supply mechanisms to indicate that non-literal interpretation is intended. For example, it has been noted that the appearance of "literally" in a sentence is a fairly reliable indicator that the sentence it appear in is not to be interpreted literally [12]. It also exploits languages' internal means of disambiguating the intended sense of an expression (even if these are periphrastic, for example, "I mean 'bank' in the sense of 'a financial institution' "). The framework offers a proof-of-concept response to Davidson's claim that metaphor is not within the remit of semantics, but of pragmatics [7]. Carl Vogel [27] provided a truth-functional compositional semantics that could accommodate metaphor and sense extension (expansion of predicates to new entities, and multiple senses for names of entities and relations), but rejected Davidson's claim that "special senses" are not involved in metaphoricity.

In contrast, it has been argued that natural language generics, phenomena well studied in the formal semantics of natural language [3–5, 15, 19], are not in the remit of semantics but of mathematical formulation of a cognitive theory of concepts [29]. One claim made to support this argument is that unlike the case of metaphor, there are no overt markers of genericity. While there is ample treatment of the ability of definite NPs, bare plurals, mass nouns and even indefinite singulars to sustain generic readings, they do not demand them. This ignores the possibility that the unmarked case is generic reference, such as in *determinerless* classifier languages where the specific reading is optionally marked as such if context does not clarify.

Hurricanes happen in the Atlantic and Caribbean. (4.12)
Leslie smoked cigarettes. (4.13)
Leslie smoked three cigarettes. (4.14)

Habituals (4.12) with unbounded subjects, and comparable constructions with terminative aspect (see [29]) make this more clear: without a specific bound or clear definite marking on the object NP in (4.13), the preference is to understand the sentence as a past tense habitual, a form of generic. On the other hand, (4.14) exhibits terminative aspect. The test between the two potential readings is in whether the sentence tolerates modification by "for a day" or "in a day" – (4.13) can be continued with "for a day" but not "in a day", and (4.14) has the reverse pattern. To obtain the specific episodic reading, explicit marking is necessary on the object NP.[3]

[3] Sheila Glasbey [9] notes that aspectual class can diverge between literal and non-literal readings of idiomatic expressions.

This article argues sense modulation processes are shared by metaphoricity and genericity. The theory invokes first-order languages which include sense-selection, traditional static interpretation and dynamic interpretation [28, 29].[4] The theory discriminates between the interpretation requirements of novel and established metaphors. The same framework is used to model aspects of both metaphoricity and genericity (the former is expansive, and the latter is restrictive in subsequent interpretation potential). This analysis resonates with one dominant theory of metaphor understanding that holds metaphors to be class inclusion statements [9, 10, (Chapter 1 by Sam Glucksberg, 2011, this volume)]. Thus, the paper also argues that the semantic analysis advocated here is compatible with and extends important aspects of Glucksberg's theory for nominal metaphors.

Section 4.2 characterizes a formal system for update and downdate [29] which is slightly richer than the starting point provided by [22] (it does not require that every element in the domain have a name; it admits multiplicity of sense; it admits sense designation into the language) and is conceptually more complete than the framework provided by [28] in forcing a clear separation between information assertion and retraction and the role of metaphoricity (Section 4.3). Section 4.4 demonstrates how the resulting system provides the restricted quantification of genericity (generics are also analyzed with special non-literal senses). Finally, the paper shows how some of the desiderata of Glucksberg's theory are met. The main explanatory mechanism of Glucksberg's theory is allowance of dual reference in the vehicle of a metaphor in its predication of the topic, ambiguous in predication of the topic between literal reference and an abstraction over that reference that retains salient attributable properties. Asymmetries of metaphors (in contrast to the symmetry of similes) are anchored in the distinction between given and new information, with respect to qualifiable dimensions in the given information and potential attributions supplied by the new information. Other desiderata (for example, conflation of subject-object asymmetry in metaphors with topic-comment information packaging) are disputed.

4.2 Dynamics of First-Order Information

4.2.1 Some Intuitions About Revision

To a child learning about the world from documentaries, it may be news that (4.15) is true. The literal truth of the statement is about NPs at the same level of abstraction.

A whale is a mammal. (4.15)
A whale is like a mammal. (4.16)

Even if the sentence is provided as a voice accompanying a picture of two whales, such that the child anchors the subject NP to one of the two whales arbitrarily, (4.15)

[4] Formal details of this system are available in an earlier version of this paper [29].

remains a literally true statement. As an accepted piece of news, the child extends whatever meaning of "mammal" was in place before, with the new information that one or more whales is also in that set. If the child knows that whales are not fish, the child may retract the prior creative hypothesis that the swimming fish-like thing is not a fish. Note that (4.16) is also true because whales are mammals, and things are generally like themselves.[5] Moreover, (4.16) is reversible: a mammal is like a whale for, among others, all the reasons that make the kind, whale, a sub-kind of mammals. This is the same as squares being like rectangles and rectangles being like squares. Of course, the simile isn't particularly felicitous given the truth of the stronger class inclusion statement of (4.15). Glucksberg notes that metaphors are not only asymmetric, they are also sometimes only reversible with a change of meaning into a different metaphor. [10, p. 45] notes the difference between (4.17) and (4.18).

Some surgeons are butchers. (4.17)

Some butchers are surgeons. (4.18)

The former presumably has negative connotations, and the latter, positive. Later the issue of reversibility returns with emphasis on the fact that the constraint is not simply on the linear presentation of topic and vehicle (see (4.34)).

Reversing (4.15), (4.19) is also felicitous – if it expresses that a specific kind of mammal is the kind "whale"; or if it means that a particular individual mammal is of the whale sort; or (least likely) if a specific indefinite is both a mammal and a whale.

A mammal is a whale. (4.19)

These properties of generics indicate that plurality of reference, the possibility of words being used in strict or loose senses with graduated literalness, with access to individuals and their kinds, is not unique to metaphorical expressions.

The point of the example (4.15) is to emphasize that there are needs for asserting and retracting information about entities and relationships that hold among entities in the world, independently of whether the utterance accepted as effecting the change fits criteria for some figure of speech or other. A mechanism for assertion and retraction is a necessary part of information processing.

4.2.2 A Formal Model of First-Order Belief Revision

Oliver Lemon [22] provided a framework for modeling first-order belief revision of incomplete theories. A theory in this framework is a set of agent beliefs about the world and the individuals and first-order relations within it. An agent can obtain new beliefs or retract old ones. Beliefs may be about the truth of propositions or of properties holding of named individuals. A common simplifying assumption is made that every individual in the domain has a name [8]. Additional beliefs may include

[5] It is felicitous for someone to say, "He is not like himself today."

quantificational statements, and in fact may be about any well formed sentence in a standard first order language. Beliefs, quantificational or not, may be added or subtracted. Rationality postulates ensure consistent belief states under deductive closure.

In retracting a belief from a theory, in general there will not be a unique sub-theory of T that fails to entail the retracted formula (e.g. ϕ). Lemon refers to maximal sub-theories of T with that status as, $T \perp \phi$, and defines a choice function α to pick out members of that set, and an intersection over all possible choices yields a total retraction of the formula ϕ from the theory T. To retract a universally quantified formula involves total retraction of a single formula in which the quantifier is removed and free instances of the erstwhile bound variable are substituted with a constant, the name of the individual which causes the universal to be retracted. Total retraction of an existentially quantified formula similarly requires retraction of all formulas obtained by substitution of each constant for now free instances of the formerly bound variable. This method adopts a substitutional approach to quantification. Names are taken as rigid designators and the naming of individuals in the domain is only ever monotonically increasing – it is not possible to un-name an individual, although individuals may have more than one name.

4.2.3 First-Order Belief Revision Adapted to Sense Extension

In general, dynamic semantics supposes that there is an input to interpretation and that the output of interpretation can be a truth value, but also a change in the model of the world that is input to interpretation of subsequent utterances. In classical logic, one thinks of a meaning function defined for arbitrary sentences relativized to a model which consists of a domain and interpretation function. In an extensional semantic analysis, the interpretation of a predicate is the set of tuples each of which the predicate is true of; the interpretation of a constant is some element of the domain. Updating or downdating means adding tuples to or subtracting tuples from the interpretation function. Additional parameters are needed for interpretation to accommodate multiple senses. Two additional aspects of context also anchor the interpretation – the default sense of an expression and the default "world" in which interpretation is happening.[6] Assuming a fixed domain, with dynamic interpretation, relativization is to the input and output interpretation function. Thus, a basic meaning function is annotated with the input and output interpretation functions (as well as assignment functions for free variables – these function like contexts that provide the reference of pronouns), accordingly. With static interpretation, the inputs and outputs are identical. For dynamic interpretation, the interpretation function may expanded and contract. The construction stipulates what arbitrary sentences of the language should mean; this is spelled out recursively with cases for each connective.

[6] An article in *The Economist* may use without penalty "bank" in an article reviewing property values on one side of the Seine.

4.2.3.1 Sense-Relative Interpretation

Interpretation is relative to models consisting of a domain of entities and an interpretation function for basic expressions in the language, which is presented in terms of the tuples comprising it. An important parameter of interpretation function is the index at which a basic expression is to be interpreted. The language supplements first-order systems as standardly presented by including expressions that designate the indices at which predications and constants are to be interpreted. While this not the way first-order systems are typically presented, it entails no more than first order expressivity: it is tantamount to having $bank^{\text{GEOLOGY}}$ and $bank^{\text{FINANCE}}$ as well-formed predicate names, where a predicate name is disambiguated with a designation of sense. Constants may similarly be accompanied by designations of sense (as a model of deixis accompanying natural language, for example). In both cases, a default sense may be assumed, and interpreting a sequence of expressions may involve changing the index at which constituent expressions are evaluated.

The system also includes the possibility of choosing between static and dynamic interpretation of expressions. Static interpretation involves inspecting what a constant refers to or testing the truth of a predication at an index. Dynamic interpretation involves either contraction or expansion: either a predication has its meaning reduced at an index so that it applies to fewer entities (or sequences of entities, depending on the arity of the predicate), or a predication has its meaning expanded at an index to apply to more entities.

4.2.3.2 Sense-Relative Assertion

In an initial proposal for analyzing metaphor with dynamic semantics, static interpretation was reserved for senses classified as literal and dynamic interpretation for senses classified as non-literal [27]. What is correct about this distinction is that the difference between a literal sense and a non-literal sense is convention in classifying it as such. Here, a partial ordering in that dimension is assumed (this emerges more below, particularly in how this relates to genericity). Evidently, people are able to perceive degrees of metaphoricity [24]. I argue that this approach is incorrect in providing belief revision only for non-literal expressions; the independent need for sense extension and contraction was motivated in Section 4.2.1

"Constants" can be supplied with new senses and references within those senses. The interpretation of a tuple of such terms requires passing the output of the interpretation of one argument into the input of interpretation of the following one. This idealization is too strong, in general, because it works on canonical argument structure, without taking into account non-canonical orderings of argument realization, through topicalization, for example. The assertional interpretation of a predication (or proposition) always succeeds relative to either a designated or default sense. It has the effect of adding a tuple (possibly empty for a proposition) to the characteristic function for the n-ary predicate for the relevant sense.

By construction, the assertional interpretation, if repeated for sufficient designations of elements of the domain, can come to make the static interpretation of the

universal quantifier work out to be true, and it can make existential generalizations true in a single application for the relevant sense. In the case of static interpretation (Section 4.2.3.1) implication and disjunction require no mention because they are defined from negation and implication. In the case of dynamic interpretation, those connectives are constrained to be static. Conjunction is given a dynamic interpretation: giving an assertional interpretation to an initial conjunct changes yields a change in the background model that serves as interpretation input to a subsequent conjunct. Thus, conjunction is not certain to be commutative in the dynamic fragment. The dynamic fragment is non-monotonic.

Further, in the underlying formal system there is no direct clause for extending the sense of a predicate within the scope of a quantifier, but doing so with individual constant terms will have the effect of making static interpretation relative to the selected sense work out to be true. Similarly, senses of predicate names and constants cannot, by this construction, be augmented under the scope of negation. However, because extension of a predicate at an index for a sense provides grounds for static interpretation of an existential generalization to be true, it equally supplies grounds for a formerly true negated existential generalization to be false. Even just addition of truths inside the model yields non-monotonicity.

4.2.3.3 Sense-Relative Retraction

I assume that names of individuals cannot be retracted.[7] Thus, names and tuples of names will be interpreted as what they mean according to a static designated sense. The output of retracting information about a particular tuple of individuals from the denotation of a predicate for some sense of the predicate is an interpretation function which is smaller (if that tuple was in the background model for the predicate at that sense in the first place), and the formula will evaluate to be false. Subsequent static interpretation of the negated formula, picking out exactly that same tuple, will evaluate as true because the non-negated form is now false.

Universally quantified formulas (possibly complex) may be retracted by deleting a tuple from the interpretation function that creates an exception. Existentially quantified formulas may be retracted by deleting all tuples that support the existential generalization. The only generalization over Lemon's work assumed in this section is that retraction of information is relativized to the sense of the predicate at stake. It uses an extensional unpacking of intensions.

4.3 Ramifications for Metaphoricity

The discussion which precedes has not provided the logic which fits the constraints on updating and downdating models as specified. Ensuring the correspondence between alterations to models and closure of the set of sentences true in those

[7] This is not an assumption without precedent [22].

models is a separate exercise. However, it can be seen from what is discussed what sentences will gain or lose support and that the entire system is non-monotonic, because the underlying models are non-monotonic: relations can expand and contract. The location of dynamic semantics for the language is in the non-logical expressions – proposition and predicate names as well as names of individuals (all relative to senses of them). It is possible to imagine varying the interpretation of the logical operators ($\wedge$, $\neg$, etc.) so that they do not behave in classical ways orthogonally to dynamism [20]; however, that is not of focus here. The language is set up such that in NPs, head noun restrictor sets; in VPs, verbal heads; in APs, adjectives and adverbs; in PPs, prepositions may expand and contract the sets that they are true of as individuals or tuples of individuals corresponding to relations.

It is assumed that these sets are the input to generalized quantifier constructions [2] to, for example, construct an NP as a set of sets which "lives on" its head noun set, and such that a positive polarity sentence involving an NP and an intransitive VP or copula-linked predication is true just if the set given by the predicate is an element of the set of sets provided by the NP. If metaphorical statements are taken to be class inclusion statements, this analysis in terms of generalized quantifiers will demand modification to achieve the same effect. In fact, the inclusion statement is that the "lives on" property holds: whether the characteristic set χ corresponding to any predicate is an element of the quantifier depends only on the intersection of the head noun set (N) from the quantifier with χ. For any χ that is in the GQ denotation supersets or subsets will either have to also be elements of the GQ denotation as well (or must not be) depending on the determiner that combines with the head noun set to form the GQ. Thus, the "lives on" property takes care of class inclusion, but also exclusions where necessary. The reason to accept generalized quantifier theory is its robust account of evidently syntactic puzzles (e.g. the "definiteness effect" in partitive constructions), semantic puzzles (e.g. licensing of negative polarity items by downwards monotone determiners), as well as predicting processing facts about natural language determiners (e.g. monotonic increasing determiners (e.g. "some" and "all") are easier to evaluate than monotone decreasing determiners (e.g. "no" and "few"), which are in turn easier than non-monotonic determiners (e.g. "exactly three")) that are supported by empirical evidence [23]. Ample reason to move to a generalize quantifier account are provided by [2]; primary is that first-order logic does not have the expressive capacity to represent the meaning of "counting" as is required by relatively mundane natural language determiners like "most" or "many".[8] Finally, in presenting the invariants associated with generalized quantifiers, [2] assumed a fixed-model constraint to address the variance in determiner meaning that depends on contextual factors like expectations. For example, a different number of people, even a different proportion of a relevant head noun set being quantified over, might count as "many" depending on the expectations. The fact, that

[8] Note that [10, p. 22] recalls experiments from 1982 to 1989 which revealed significant differences in responses to metaphorical statements with quantified subjects depending on the determiner of quantification ("some" vs. "all"); one might anticipate that a wide range of variability is indexed by exactly the monotonicity properties of the determiner.

the cardinality or ratio involved in "many" is to be interpreted with varying models in generalized quantifier theory is a background support for the kind of variation in interpretation depending on signaled sense to account for aspects of metaphoricity in this paper. Consider the highlighted portion of (4.20).[9]

There was never a solicitation for money at these events, but of course, the President hoped that people in this category of friends and prior supporters would give money afterwards. *And, in fact, many did, and many did not.* (4.20)

It is clear that metaphoricity is handled here by classification of senses of predicates as metaphorical or not, and degrees of metaphoricity can be represented. It remains to discuss more about the nature of the distinct senses of predicates and what makes them stand in special relationships to their base forms. The basic idea is that by addressing predicates and their related senses, one has access to a larger characteristic function for the set than is relevant to any literal sense of the predicate. Each possible sense is the characteristic function corresponding to an abstraction over salient properties associated with the characteristic function for the predicate. "Duality of reference" in Glucksberg's terms is a species of polysemy in which a predicate name can pick out its literal sense, or be used as a metaphor, picking out an otherwise un-named superordinate concept or category at a level of abstraction determined by the context of use (Chapter 1 by Sam Gluchsberg, 2011, this volume). There can be any number of such abstractions, and one does not expect each of them to have a unique name [10]. As constructed here, each additional sense of a predicate has its own characteristic function, and as has been seen, the set determined by each such function can be expanded or contracted using the dynamic interpretation mechanisms specified above. Equivalence classes of senses of a predicate form the space of polysemy for a predicate (as distinguished from its having unrelated homonymic senses), and all of the tuples in the entire equivalence class form a larger set than those in the basic literal sense.

The framework is outlined as above with extensional treatment of types. As such, the system can also be compared with the work of [21], who presents a framework in which linguistic tokens paired with situations appropriate for use (relativized to speakers) can be seen as individuating senses of the tokens that modulate through dialogue, addressing the kinds of circumstances that shape meaning changes.

4.4 Metaphoricity and Genericity

As constructed, predicates cannot be extended to cover new tuples under the scope of negation, but negations can be made true by retracting tuples from the characteristic functions of particular senses of predicate names. It is tempting to say that novel use of metaphor involves the generation and population of new senses of predicates;

[9] Attributed to Lanny Davis, special White House counsel, February 25, 1997. OnLine Focus interview with Elizabeth Farnsworth (http://www.pbs.org/newshour/bb/white_house/february97/davis_2-25.html) — last verified January 2011.

conventionalized metaphor is about the re-use of old senses, and dead metaphor does not even involve extending the predicate to a fresh set of tuples. However, it is key that information assertion and retraction about individuals and tuples of individuals is independent of metaphoricity. It happens with literal information also.

Discriminating sense makes it possible to consider subsets of the interpretation function as bundling predicates together by senses that are shared. For example, there is a financial institution sense of "bank" that is in common with a particular sense of "bond". The two words do not mean the same thing: even relative to that shared sense the words participate in different networks of implications and are true of different tuples. A partial order relation names paired with their senses provides a cline of metaphoricity. The different senses of predicates will generally be true of differing sets of tuples, and metaphorical denotations tend to be disjoint from literal counterparts. The total union of sense denotations for a predicate, a single "loosely speaking" version, has more than a constituent literal denotation univocally.

Genericity provides an alternative sense to predicates that has nearly identical properties to metaphorical sentences, but on the analysis provide here, they are explained by appeal to construction of related contracted senses of predicates. Like metaphors, generics can be predications over nominals (4.21), (4.22), and (4.23) or can involve the verbs directly as well (4.24). Generics certainly cannot be understood as universally quantified statements in a classical framework, as their nature is to have exceptions. Thus, if generics are taken to be category inclusion statements, they turn out to be false in their strict literal senses. However, generics cannot be truthfully understood as asserting even that *most* of the entities in the subject NPs head noun set have the predicated property, because (4.21), (4.22), and (4.23) would remain true if there tend to be more male platypuses than female ones, or even if most platypuses die before reaching the age of being able to reproduce. Similarly, (4.24) might be uttered to mean that the only time Leslie smokes, it's after dinner, or among the times that Leslie smokes, after dinner times are included. The safest "strong" reading of a generic in first-order languages is that the sentences make an existential claim that, for example, there is at least one platypus that has produced an egg. Equivalently, one can appeal to a universal claim over a set that has only one element, essentially evaluating the predicate at an index where the denotation is small enough to have no counter-examples. The simple existential readings are a challenge for sentences like (4.25) in which there is no real entity in the domain that satisfies the existential generalization, but universal quantification at an index where the domain is empty appears satisfactory.[10]

The platypus is an egg laying mammal. (4.21)
A platypus is an egg laying mammal. (4.22)
Platypuses are egg laying mammals. (4.23)
Leslie smokes after dinner. (4.24)
Unicorns are white. (4.25)
An egg laying mammal is the platypus. (4.26)

[10] However, at those indices, "unicorns are not white" is also true.

The truth conditions of generics are as troubled as those of metaphors. Reversing the predications is possible, but changes the meaning slightly, admitting a Gricean implicature in (4.26) that there are other egg laying mammals as well. This reversibility is comparable to that mentioned above for metaphors (recall (4.17) and (4.18)).

Returning to negation, (4.27) was discussed above (4.10) as containing sentential negation. It may also be understood as expressing a more local negation synonymous with (4.28). In this case it retains interpretation as a generic. In the account proposed, the evaluation of both sentences involves recourse to designated senses of the predications "not Japanese" and "sumo wrestlers" such that the instances of the latter are all among the former. Deep analysis of the predicates establishes the synonymy of "not Japanese" and "Gaijin" using meaning postulates (see e.g. (Chapter 3 by Jerry R. Hobbs and Andrew Gordon, 2011, this volume)).

Sumo wrestlers are not Japanese. (4.27)
Sumo wrestlers are *Gaijin*. (4.28)
Dodos are extinct. (4.29)
Dodos are no longer living. (4.30)

Similarly, purely kind-level predications such as (4.29) can can be addressed in extensional terms as in other approaches to generics [14].[11] Predications of kinds may be seen as equivalent to related predications of instances of the kinds. Kinds can be constructed from classes of available extensions of the corresponding predicates expanded at some indices of evaluation and contracted at others. The effects associated with "duality" of reference between kinds and their instances are attributed to picking some index or other for evaluation on one hand, or on the other hand, considering a collection of indices versus a particular index within the same sense: a plurality of reference is available. However, reification of kinds (or any other abstract notion) as the potential referents is not antithetical to the programmatic analysis argued here.

As mentioned above, indices for the evaluation of senses of predicates can be grouped according to semantic fields (so that, for example, $instrument^{\text{FINANCE}}$ may be preferred over $instrument^{\text{MUSIC}}$ when evaluating a sentence that has a prior mention of $bank^{\text{FINANCE}}$). This incorporates insights from the field of cognitive linguistics in which conceptual metaphors deliver families of predicates interpreted according to the same designated indices for evaluation (Chapter 2 by Andrew Goatly, 2011, this volume). Simultaneous ordering of indices according to categories orthogonal to semantic field, such as partial orderings by degrees and kinds of affect are also possible – this is in the spirit of the analysis of modality provided by [18] with a double-ordering of "possible worlds" according a modal base (that determines which sort of modality) and an ordering source which provides

[11] That work is mainly concerned with an analysis of bare plurals as not specifying explicitly their intended quantificational force over a domain named by a predicate; by comparison, the present work can be seen as advocating universal quantification for bare plurals always, but with variation in the size of reference set depending on the sense selected for the head noun predication.

accessibility relations. Rather than encoding affect associated with predications as other object-level predications, such as proposed elsewhere (Chapter 3 by Jerry R. Hobbs and Andrew Gordon, 2011, this volume), affect here is encoded in meta-level classification of senses.

It is common to understand generics as involving a restricted domain of quantification over salient individuals. This is the converse of what happens with metaphor understanding. Thus, the proposal to unify the treatment of metaphoricity and genericity in this dynamic framework is to allow for alternative senses of literal predicates which are reduced by individuals or tuples[12] that challenge the literal truth of universal quantification over the full domain. Metaphors are class inclusion statements that involve expanding hitherto un-named categories, and generics are class inclusion statements that involve shrinking categories with prior names. Among the alternative senses for predicates are those which stand systematically in this way via relevant restriction over the characteristic set of the predicate at some sense.

4.5 Particulars of the Class-Inclusion Framework

One aspect of the system that merits discussion is its relationship to the theory developed by Glucksberg and his colleagues. There is some divergence with respect to the question of asymmetry of metaphor, which I argued above extends somewhat to genericity. The divergence is in that the system doesn't place great emphasis on the asymmetry beyond the order of arguments in a tuple, which is in each case an ordered sequence. The system, through multiplicity of senses for predicates and terms, admits duality of reference, but it is not prejudiced to require that the dual argument must be in a non-subject position. Interestingly, [10] comments in a number of places less on the asymmetry of subject and object, as with respect to new and given. This is also called the topic-comment distinction, and it often in English coincides with the grammatical subject, but it is not analytically identical [20].

Einstein [my brother points at a clever companion] can work out how the remote control works. (4.31)

It is sharks that lawyers are. (4.32)

Sharks, Lawyers are. (4.33)

First of all, (4.31) shows that the Demjanjuk examples of [10, p. 40] involving abstract categories can occur in subject position. The cleft (4.32) and topicalization (4.33) are both constructions that move canonical objects into a topic position for information packaging purposes, and in these cases it turns out to be the abstract category that form topic, and the finite sentence with an object gap that forms a predication for the comment. Perhaps one would want to argue that the subject remains given in these and related constructions, but it is clear that it is not the linear order of presentation that matters as much as the information packaging into topic and comment.

[12] Individuals are singleton tuples, anyway.

However, a more robust class of examples of non-literal expressions best understood as class inclusion statements, but with the class in the initial position, has an exemplar in (4.34).[13] This construction relates directly to predication metaphor (4.35). A counterpart construction for simile is perhaps anomalous (4.37).

"Anyone who has lived in the ethnic shouting match that is New York City knows exactly what I mean" (4.34)
New York City is an ethnic shouting match. (4.35)
Anyone who has lived in the New York City that is an ethnic shouting match knows exactly what I mean. (4.36)
the jail that is like Sandy's job (4.37)

In (4.34) both terms of the predication can be understood via literal referent or as concepts, but there is evidently a preference for "the ethnic shouting match" to be understood as a name for category which is asserted to have the literal New York City within it. The relevant non-literal constituent of (4.34) can be equally understood via (4.35). An adapted formulation is provided in (4.36) to show that reversibility does obtain and "New York City" does not appear to be forced into a sub-kind level expression, although it has to be at least a category here for the definite reference to work. The point is that there is more to explore about the asymmetry facts associated with metaphor. They appear to be not simply about the order of presentation of topic and vehicle and their reversibility. The facts seem to depend upon the construction which is used to package the relevant information.

In the underlying formal system here, a sequence of arguments to a predicate is assumed to be interpreted in the order given. Where interpretation is dynamic, the interpretation function that results as the output of processing the first argument is the input to the second, and so on. The tuples are ordered by the argument structure of the predicate, rather than the information packaging of the construction it appears in. There may well be empirical consequences that depend on alternative information packaging associated with argument terms, but it is not clear that they have much significance. That is, while a tendency to restrict reversibility of arguments and correlation with topic-comment structures may be useful diagnostics of metaphoricity, the dual reference theory seems to be able to stand up independently in cases where the data seems slightly at odds with the asymmetry claims.

In particular, the dual reference theory provides an intuitive explanation for the fact that similes can be restated in stronger term as metaphors, and for the (non-universal) potential for metaphor to be paraphrased with simile, evidently shifting between non-literal and literal senses of a predicates. (Chapter 1 by Sam Glucksberg, 2011, this volume).

Sumo wrestlers are like elephants. (4.38)
Sumo wrestlers are like Japanese people. (4.39)
Squares are four sided equiangular polygons. (4.40)
Squares are like four sided equiangular polygons. (4.41)

[13] Attributed to Andrew Sullivan by [25].

On Glucksberg's theory, sentences involving nominal metaphors are class inclusion statements that refer to a category superordinate to the literal sense of a named predicate, where the superordinate level is determined as appropriate in the context of use. A simile can be re-expressed as a metaphor that makes use of the superordinate category as the sense of the predication. Only those sentences which are interpreted using the sense provided by the dual reference can be felicitously paraphrased with a simile. Contrast the capacity of (4.1) from the outset of the paper to be paraphrased with (4.38) and the inappropriateness of (4.41) as a paraphrase for (4.40): literal class inclusion statements do not involve dual reference in Glucksberg's sense. However, consider (4.3) in relation to (4.39) – even changing the predicate adjective in the generic to a predicative nominal for parallelism in (4.39) doesn't improve the formulation with explicit comparison. Generics function as class inclusion statements also. However, above in Section 4.4 it was argued that generics make dual reference to categories as well, but, to subordinate categories. This clarifies part of the force of Glucksberg's sense of dual reference: it is not just polysemy between a category and a hierarchically related one; rather, it crucially involves a category superordinate to the literal sense. Subordinate categories lacking prior names, universal quantification over which supports the truth of their generics, in contrast to the superordinate categories in the case of metaphors, do not participate in the all the same effects. Whereas the superordinate categories can lead to more emergent associations in the comparative constructions constituted by similes, the subordinate categories of generics necessarily yield tautologies in combination with the predication. These resist emergent associations, and are thus extremely odd.

It is important that the formal framework outlined in Section 4.2.3 addresses more than nominal metaphors linked by copular verbs which comprise the primary focus of (Chapter 1 by Sam Glucksberg, 2011, this volume). An example like (4.42) does not evidently make recourse to superordinate categories for either the subject or object nominal, nor does it obviously convey a class-inclusion statement, but it does involve dual reference with a (metaphorical) superordinate sense of "eats". As before, static interpretation can be used to evaluate the the statement as a contingent declarative, or dynamic interpretation can be used to assert its truth, updating the interpretation function. Of course, the formal details require elaboration to capture even an extensional interpretation of the verbal noun subject and the mass noun object in this example. A richer type-theoretic system such as that described by [6] will ultimately be necessary.

Covering news in the field eats money.[14] (4.42)

Sal smokes a Cuban cigar. (4.43)

Similarly, the habitual in (4.43) is interpreted via selection of a sense of "smokes" that refers to a category subordinate to the literal sense in terms of the quantification involving Sal and cigars – it has a smaller extension where universal quantification holds. Moreover, there are a number of such subordinate senses corresponding to

[14] Attributed to George F. Will by the American Heritage Dictionary.

the ways in which the habitual is to be understood (e.g. Sal prefers Cuban cigars; when Sal smokes a cigar, it is a Cuban one; there is only one type of Cuban cigar that Sal smokes; etc.). Interpretation of both is mediated by hierarchically related senses. Perhaps because neither is constructed as a class inclusion statement that could yield a tautology, both the metaphor and the habitual support reformulation as explicit comparison statements as in (4.44) and (4.45).

Covering news in the field consumes money like termites eat wood. (4.44)
Sal consumes a Cuban cigar like Bond drinks a shaken martini. (4.45)

In any case, the dual reference constraint between nominal metaphors in class inclusion statements and paraphrase with similes is not available for metaphorical verbs.

4.6 Final Remarks

This paper has argued that metaphoricity and genericity are best handled within the same semantic framework, one that admits information update, names of individuals and predications paired with senses. The formal machinery has been sketched in an extensional unpacking of the main ideas. Pairs of predicate names and senses can be partially ordered to achieve a continuum of metaphoricity. They may also be classified according to other meta-linguistic categories, affect among them. Sam Glucksberg (Chapter 1 by Sam Glucksberg, 2011, this volume) has argued that metaphors are best analyzed as class inclusion statements involving dual reference. Generics and habituals certainly look like class inclusion statements and show many of the same properties of non-literal interpretation that metaphors do. It has been shown exactly how metaphors relate to each other within a non-monotonic system for information change.

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Chapter-4

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